With the Writer's Compts.

11

VARIOUS

MORPHOLOGICAL PAPERS,

ILLUSTRATED BY FIVE AUTOTYPE AND THREE LITHOGRAPHIC PLATES:

(I.) On the Position of Anatomy in general and the Central Nervous System in particular, with Lime-light Demonstration of Anatomy from the Morphological Side (Macroscopic, Minute, and Developmental).

(II.) On the Lobus Olfactorius Impar.

(III.) On various Single and Double Monstrosities, with remarks on Anencephalic and Amyelic Nervous Systems.

(IV.) A Case of Complete Transposition of the Thoracic and Abdominal Viscera.

BY

ALEC FRASER,

PROFESSOR OF ANATOMY, ROYAL COLLEGE OF SURGEONS IN IRELAND.

Reprinted from the Transactions of the Royal Academy of Medicine in Ireland, Vol. XII.

DUBLIN:
PRINTED FOR THE AUTHOR
BY JOHN FALCONER, 53 UPPER SACKVILLE-STREET.

1895.

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(I.)

ON THE POSITION OF ANATOMY IN GENERAL, AND THE CENTRAL NERVOUS SYSTEM IN PARTICULAR, WITH LIME-LIGHT DEMONSTRATION OF ANATOMY FROM THE MORPHOLOGICAL SIDE (MACROSCOPIC, MINUTE, AND DEVELOPMENTAL).

THE first half of this Address, of which the following is a summary, was called forth by the letters which appeared in *Nature*, October 26 and November 9, 1893, from Professor Ray Lankester, of Oxford. Coming from a man of his acknowledged standing and eminence, being, as he is, the most distinguished of the young school of English morphologists now remaining, and the matter they contained being from his point of view unfortunately too true, led me to contrast the position and the conditions under which the teachers of human anatomy in Germany and in the three divisions of our own country have to work. No one knows better than Professor Ray Lankester that matter of the same character could not be used by a professor, however eminent, in the philosophic or natural science faculty, in any German university, in reference to his scientific colleagues of the medical one, often quite as eminent as himself.

In doing so I had to enter into some detail in regard to the manner in which medical teaching was done in our own country—by universities, by colleges, and by private enterprise, the latter more especially in London, to some extent in Edinburgh and Glasgow, and also, up to a very recent date, here in Dublin. In Germany, on the

other hand, all medical teaching was done by universities only, and by teachers appointed by the State. Comparable acquirements and results in the shape of morphological contributions to knowledge could only be looked for in our own country from those holding university positions, or similar ones in certain of the metropolitan or provincial colleges, who were in the fortunate position of having a certain amount of leisure apart from their teaching duties.

In order to appreciate or understand Professor Ray Lankester's position it was necessary to note the rise of the young school of English morphologists, due largely to the scientific insight and forethought of the distinguished Professor of Physiology in the University of Cambridge, who, associated with his famous pupil, the late Professor F. M. Balfour, created the great school of morphology in connection with that university, the Oxford side being represented by the late Professor Moseley, and now by Professor Ray Lankester.

The older representatives of English natural science were generally medical graduates. Professor Huxley, by far the most distinguished of those who remain, had such a training.

The young school, however, have little, if any, connection at all with medicine, and judge us and our work by the pure scientific standard, and it is in this sense that Professor Ray Lankester's judgment must be said to be true.

The human morphologist's vision must from its nature be always a more limited one than that of the comparative morphologist, and he must recognise that it takes a Darwin to write of the "Descent of Man," a Huxley to fix his "Place in Nature," a Haeckel to speak of his "Evolution," and a Weismann to raise controversy regarding the "Continuity of his Germ Plasm,"—that these are men who have garnered in their minds all the knowledge of their time in respect to organic nature, who are able to formulate

new conceptions, and to change the current of thought in almost every branch of knowledge.

The second half of the address was taken up by throwing on the screen examples of the manner in which my inward thought had endeavoured to make for itself outward expression during the preceding ten years. The screen pictures exhibited were from slides, reductions from my 15 × 12 inch negatives. Of the latter I had made nearly one thousand, exhibiting original observations on vertebrate morphology and embryology. More than half the number dealt with the anatomy of man in his infantile and adult stages; his external form in various positions and actions (from the living model), also his internal structure, with particular reference to his central nervous system.

The smaller half dealt with the embryology of the dog-fish and salmon among fishes, with that of the frog and newt among amphibians, with that of the chick, duck, and canary among birds, and with that of the rabbit, rat, mouse, guinea-pig, hedgehog, mole, calf, sheep, pig, dog, cat, monkey (two examples), and man amongst mammals. My observations have thus covered all the divisions of the vertebrata except reptiles, the embryos of which I have hitherto been unable to obtain, except one of a rattlesnake.

I have not only photographed the external form of the several examples mentioned under the different classes, but also the serial sections into which the embryos have been cut at a direct enlargement of from ten to twenty times, so that the whole internal form can be read from the prints taken from the negatives without the trouble of looking down the microscope. The prints can be made transparent, and the sections placed in order one over the other; reconstruction figures or even models can in this way be made with the greatest ease.

My observations have of necessity been much more complete in certain examples than in others. In the rat I have,

both as regards external form and serial microscopic sections, a very complete series of specimens at intervals of four hours from the eighteenth hour after union of the sexes up to birth, which occurs at the end of the third week. In the human example I have also been able, by the kindness of many friends in Dublin and in various parts of Ireland and England, to make and work over an almost complete series of specimens, varying in length from less than 10 mm. up to birth.

In addition, I have photographed complete series of sections made in the sagittal, coronal, and horizontal directions of the adult brains of the cat, dog, seal, rabbit, monkey, and man, in the last, also at birth, and at several intervening stages.

I had made 150 slides for the screen, selecting examples from all those stated in the preceding summary of my work; time, however, prevented me from showing more than one hundred.

The Plates which accompany this summary I have had made in order to give readers an idea of those which were thrown on the screen.

As the number had to be limited I selected negatives for reproduction which dealt with the anatomy of human fœtuses (Plates IV. and V.), or with that of the human embryo and lower mammal (Plate I.). Plates II. and III. were selected to show the aid which photography can give in the easy reading of serial sections, and the many uses to which these can be applied.

All the Plates are reductions from 15 × 12 inch negatives, except, of course, the lithographic ones, which were made simply as explanatory of the preceding five.

EXPLANATION OF THE PLATES.

The first three Plates require to be studied or observed with the heading of each turned towards the right hand of the observer, and in my remarks in reference to these

three I will take it for granted that the reader is so observing them.

The remaining plates are to be studied in the direction of the heading.

Plate I. represents mainly a series of rat embryos at different ages and from different aspects; there is in addition a very fine human embryo and a canary bird embryo.

The embryos are arranged in three rows, of which the lower is double towards the right hand. Of the four embryos which form the double part of this row, the two smaller are at 10 days 16 hours date after union of the sexes. The heart, and the cephalic and allantoic ends of the embryo can be noted. The medullary groove, except in the region of the mid-brain, is still in great part unclosed. The two larger are at 11 days 16 hours, at which date the various divisions of the encephalon can be recognised. Of the visceral arches, the mandibular is the most prominent, and the limbs are budding from the side of the trunk.

The remaining five embryos of this lower row and the two at the right hand of the second row are seven members of a family of rats at 12 days 16 hours. Four of the seven show the lateral aspect, two the front aspect, and the remaining one (the last at the left hand of the lower row) the dorsal aspect, in particular the fossa rhomboidalis, the beginning cerebellum and the mid-brain.

In all these embryos the several divisions of the central nervous system can be readily observed, the budding hemisphere brain, the thalamic and mid-brain, the isthmus, the two lateral plates which are to unite to form the cerebellum, and the great extent of the after brain or medulla—all are to be noted.

Of the three remaining embryos of the second row, the last one at the left hand is the front aspect of a canary embryo of about the sixth day. The other two and the two at the left hand of the upper row are four members of a family of rats at 13 days 16 hours. The two of the

upper row show the lateral aspect and have the fœtal placenta attached; the two of the second row show the ventral and the dorsal aspects.

The remaining embryo at the right hand of the upper row is the finest human embryo, at this stage, in my possession. It is at the same stage of development as the rat embryo of 12 days 16 hours immediately underneath it in the second row.

The two can be compared and conclusions can be drawn by each man for himself, according to his leanings and the knowledge he possesses for forming an accurate judgment.

All the embryos on this plate are enlarged about three times. In Plate VI., Figs. 1 and 2 are enlargements of the human embryo and the rat embryo of 12 days 16 hours spoken of above. I have in these diagrams roughly marked in the various divisions of the central nervous system—the hemisphere brain, the thalamic and mid-brain, the isthmus (the depression between the mid-brain and cerebellum), the cerebellum, the medulla with its thin roof, and the spinal cord. In connection with these can be seen the neck, pons, and cephalic flexures, the first of these being much better marked in the human than in the rat embryo. The nasal groove, the eye, the ear, as well as the various visceral arches—the maxillary, the mandibular, the hyoid, and the first branchial, the second branchial being covered in—the heart, the liver, the fore and hind limbs, the umbilical cord, and the primitive segments in the trunk region are all to be noted.

Plate II. represents the sections under the cover-glass of one of my serial slides of a sheep embryo. They are enlarged about four times the size of nature, and the direction in which the sections have been made through the head can be read from the long vertical section, Fig. 3 of Plate VI., by connecting the numeral 4 of 4th ventricle with the *t* of the word striatum. The sections run in rows of six, the one most cephalad being at the right

hand of the lower row, the last of the sections—that in the caudal direction—being at the left hand of the upper row.

The medulla is cut in the region of its greatest width, and the membranous roof is in two divisions. In the majority of the sections the tænia of the medulla has made its appearance. The cut thalamic and hemisphere brain lie cephalad of the head flexure.

I have marked in the names of the several noteworthy features of the sections in Fig. 7 of Plate VIII., which is an enlargement of one of them. Part of the epithelial lining of the dorsal half of the thin medullary roof of the 4th ventricle has disappeared, the first step perhaps in the formation of the foramen of Majendie. The inrolling of the hemisphere wall to form the striatum, the fusion of this with the subthalamic portion of the thalamic brain, the ending of the choroid plexus at the bottom of the interpallial fissure, and its succession by the thickened part of the anterior wall of the thalamic brain, from which will arise the anterior pillars of the fornix and the callosum, the cavities of the third and lateral ventricles with the foramen of Munro, are all to be distinguished.

Plate III. represents an enlargement about three and one-third times the size of nature of the sections under the cover-glass of one of my slides, from a series of long vertical sections of the sheep. The sections are very oblique, so that the spinal cord is not shown, although all the divisions of the developing encephalon can be recognised. I have given an enlargement of the head portion of one of the sections—Fig. 8 of Plate VIII., with the names of the several divisions marked in. With this Fig. has to be associated Fig. 3 of Plate VI., which is an enlargement of a section from a long vertical series of a younger embryo, in which the cutting-plane fell almost parallel with the median one of the embryo. The Fig. does not represent the exact median plane, but is a little to one

side of it, cutting the wall of the embryonic spinal cord instead of the central canal, and showing the hemisphere outgrowths, which would not be shown had the section been exactly median. The infundibulum, the optic and mammillary recesses of the thalamic brain, the striate part of the hemisphere brain with the hypophysis from the primitive mouth cavity can all be noted. In Fig. 8 of Plate VIII. the anterior and posterior divisions of the central olfactory apparatus, the striatum, the third and lateral ventricles, the choroid plexus, the nasal, and the superior and inferior maxillary regions of the face, as well as the remaining structures, the names of which are given in full, are to be observed. In addition to the head end of the embryo in Plate III., the heart, the lungs, the curve formed by the ribs, the liver, the intestinal tube, the Wölffian body, the genital eminence and tail are all shown.

Plate IV. represents a series of nine human fœtuses, with the brain and spinal cord of a tenth. They varied in length from $7\frac{1}{2}$ cm. to 20 cm., natural size (head and trunk measurement, the head extended on the trunk, not flexed, as in the ordinary intra-uterine position). They are all reduced to about one-third the size of nature.

Four of the smaller ones, from $7\frac{1}{2}$ to 11 cm. in length, have been cut along or near the median longitudinal plane, and the two halves lie adjacent to one another. All the four show the transitory fissures on the median surface of the hemisphere wall. The presence of these on this aspect is to be correlated with the fact that this part of the wall at this stage (before the appearance of the callosal fibres) is by far the thinnest portion.

The cranial aspect of the hemisphere wall in these four, and at much later stages in well-preserved specimens, is, in my experience, always smooth. It is so even after the callosal fibres have appeared, at which date the transitory fissures of the median aspect of the wall have disappeared, with one, or at the most, two exceptions. These tran-

sitory fissures are arranged radially along the median aspect, and run at intervals from its dorsal to its ventral border. They are eight in number in my specimens.

Of the remaining five fœtuses on the plate the hemisphere of the smaller one (in the second row) has been dissected to show the lateral ventricles from the front. The olfactory lobes at this stage are still hollow, and communicate freely with the ventricular cavity.

In the remaining four the callosal fibres have appeared. The largest of the four—that at the left upper border of the plate—shows the median aspect of the hemisphere brain, where the callosum, the parieto-occipital fissure, and the beginning of the calcarine can be seen, as well as the lateral aspect of the mid- and hind-brain.

The remaining three show the dissections made to expose the ventricular aspect of the median wall of the hemisphere brain. In the largest of the three—the second at the left upper border of the plate—the striatum has been turned down by cutting the peduncle uniting it with the thalamus.

In the fœtus at the left lower border of the plate the striatum has been removed altogether, and is shown on the plate, lying adjacent to the head.

Of the remaining fœtus the head only has been dissected, and appears by itself at the left hand of the second row.

The brain and cord shown by itself also on this row was placed in to show the calcarine fissure arising independently of the parieto-occipital, thus differing from its mode of origin in the fœtus at the left upper border of the plate. In order that the reader could follow more clearly the remarks made here, I have given in Plate VII. two diagrams—Figs. 5 and 6—of the two fœtuses at the left lower border of Plate IV., natural size, with the main features of structure marked in. Fig. 5 is after the appearance of the callosal fibres, Fig. 6 before their appearance.

In Fig. 5 the cranial aspect of the hemisphere wall was smooth, the striatum being simply turned down to show the cut peduncle (in this respect differing from the photograph in which it lies separate from the head). The choroid plexus was removed to show the choroid fissure. The septum pellucidum was completely absent, and the adjacent ventricles were thus thrown into free communication otherwise than by the foramina of Munro. The fornix, the hippocampus major and minor, the hollow olfactory lobe, the optic nerve, the divisions of the cephalic half of the striatum, and the thickness of the hemisphere wall are all to be observed.

In Fig. 6 the transitory fissures are present on the median aspect of the hemisphere wall. The fissure separating the olfactory lobe from the adjacent hemisphere runs radially and serially with the others, but it is not transitory in character. Sufficient attention has not as yet been paid to this feature. The median aspect of the remaining divisions of the encephalon are also given in this Figure. The thalamic brain with its optic, infundibular, and epiphysial outgrowths, its thin roof, from the epiphysis to the foramen of Munro, as well as its anterior wall from the foramen of Munro to the optic recess, can be noted. In the dorsal half of this anterior wall arise the anterior, the fornix, and the callosal commissures, the true history of which has yet to be written. The mid-brain, the isthmus, the hind- and after-brain are also to be seen.

For purposes of comparison with Fig. 6, I have given a median section through the head of a fœtal dog (Fig. 4 of the same plate), and of a chick (Fig. 9 of Plate VIII.). The amount of hemisphere brain in all three can be noted with the respective olfactory outgrowths. The thalamic brain does not differ so markedly in the human and dog diagrams as in that of the chick, where the epiphysial outgrowth is very large and directed towards the front.

The optic commissure is also very much larger in the chick than in either of the others. The mid-brain region of the dog is much more extensive than in the human, and it is not covered by the hemisphere brain. In the chick it is still more extensive than in the dog, but laterally its real extent is not shown in median section, this falling between its lateral outgrowths. The median section of the cerebellum is also much more extensive in the chick than in either of the mammalian diagrams.

The reader must understand in this comparison that the diagrams of the chick and dog are enlarged $3\frac{1}{3}$, whilst that of the human is natural size.

Plate V. represents the lateral aspect of the central nervous system of two foetuses, about 31 cm. in length natural size (head and trunk measurement), and supposed to be about the eighth month. They are reduced in the plate to about one-third the size of nature. They require little, if any, explanation, as the anatomy is clear. The central sulcus and the two central convolutions are easily made out on the cranial surface of the respective hemispheres. The various opercula do not as yet in either of them cover in the central lobe. The cephalad ends of the temporal lobes are still in some measure smooth. The features mentioned are common to the hemispheres of both foetuses, but in the regions cephalad and caudad of the respective central convolutions a single description would not be applicable, this being more true for the caudad direction than the cephalad one.

In this plate and in Plate IV. a large amount of the visceral anatomy of the thoracic and abdominal cavities is shown. It is not my purpose in this short summary to enter into this at all, but attention may be drawn to one feature of interest in connection with the vertebral column. A glance at the various dissected foetuses on Plate IV. will show that the curves in the neck and lumbar regions of

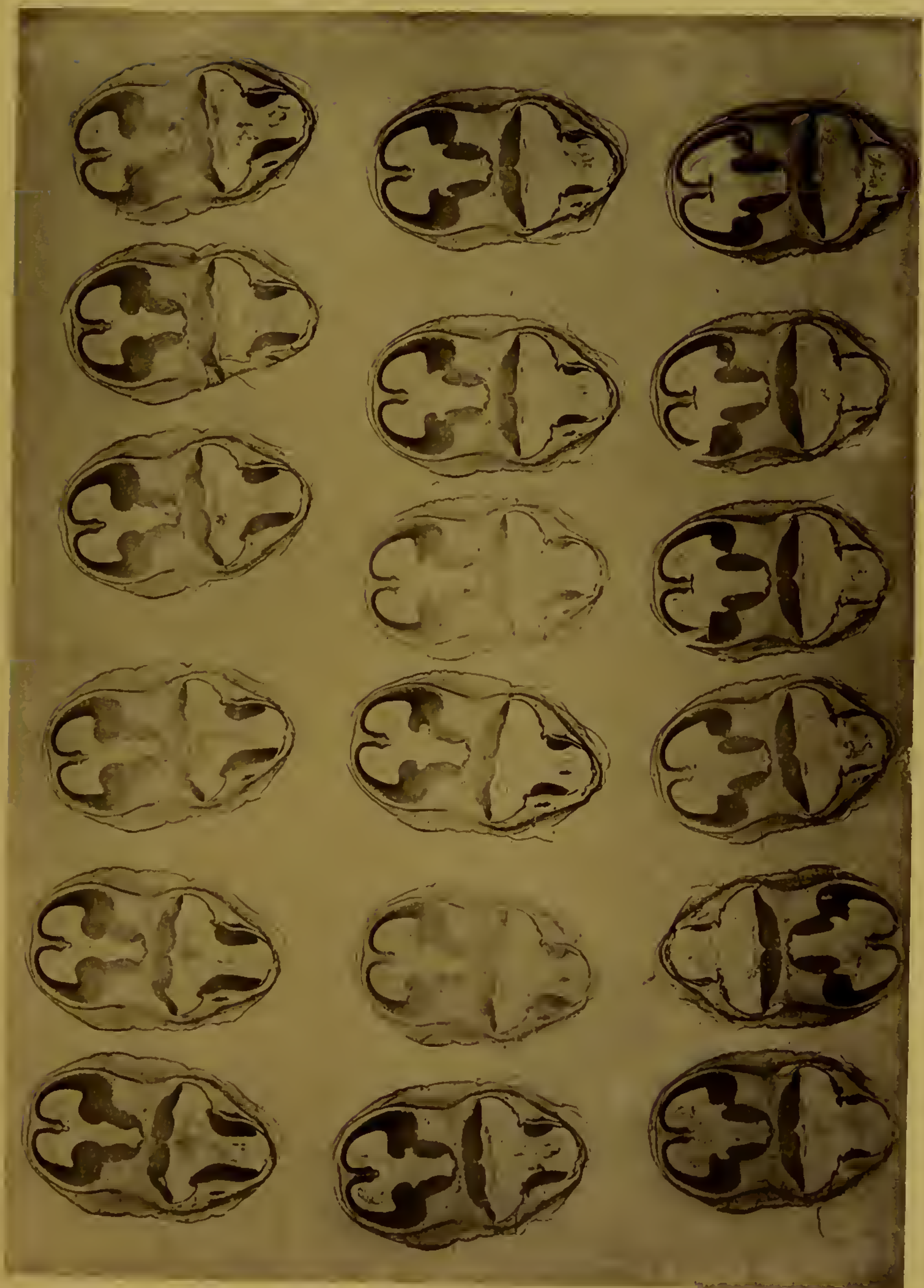
the column depend to a large extent on the position of the head and the inferior extremity; by flexing or extending the one or the other, the bends in the neck and lumbar regions can be produced or made to disappear at pleasure.

Plates VI., VII., and VIII.—I have already described the various figures on these plates in the course of my remarks regarding the preceding five. In regard to the lettering which appears upon them, I have abbreviated the words in many instances, but I have always used the first and succeeding letters of the respective word in the abbreviations. I append a list of these :—

Hem. brain	has been	used for	Hemisphere brain.
Str.	,,	,,	Striatum.
Ant. olf.	,,	,,	Anterior olfactory.
Post. olf.	,,	,,	Posterior olfactory.
Olf.	,,	,,	Olfactory.
Chor. plex.	,,	,,	Chorpid plexus.
Lat. vent.	,,	,,	Lateral ventricle.
For.	,,	,,	Fornix.
Hip. major	,,	,,	Hippocampus major.
H. min.	,,	,,	Hippocampus minor.
Ped.	,,	,,	Peduncle connecting thalamus with striatum.
P. b.	,,	,,	Pituitary body.
F. ch.	,,	,,	Choroid fissure.
O. n.	,,	,,	Optic nerve.
F. M.	,,	,,	Foramen of Munro.
Th. br.	,,	,,	Thalamic brain.
Co.	,,	,,	Optic commissure.
Opt. rec.	,,	,,	Optic recess.
Inf.	,,	,,	Infundibulum.
3rd vent.	,,	,,	Third ventricle.
M. B.	,,	,,	Mid brain.
Cr.	,,	,,	Crus.
Cr. flex.	,,	,,	Cranial flexure.
Med.	,,	,,	Medulla.
4th vent.	,,	,,	Fourth ventricle.
Cer.	,,	,,	Cerebellum.
Max.	,,	,,	Maxillary arch.
Man.	,,	,,	Mandibular arch.
1st br.	,,	,,	First branchial arch.
Sup. max.	,,	,,	Superior maxilla.
Inf. max.	,,	,,	Inferior maxilla.
Umb. cord	,,	,,	Umbilical cord.
Ali. canal	,,	,,	Alimentary canal.

DR. ALEC. FRASER

ON THE CENTRAL NERVOUS SYSTEM.



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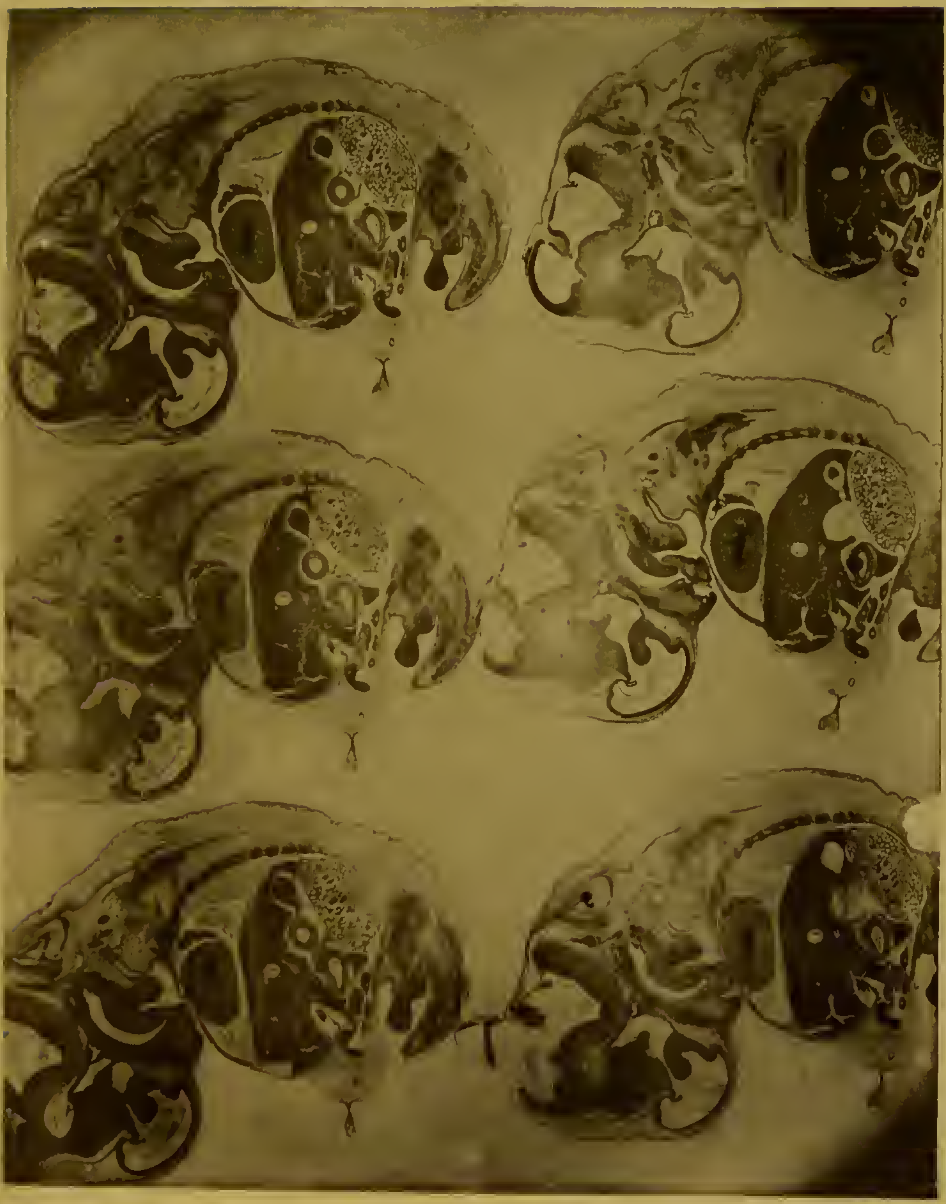
ON THE CENTRAL NERVOUS SYSTEM.



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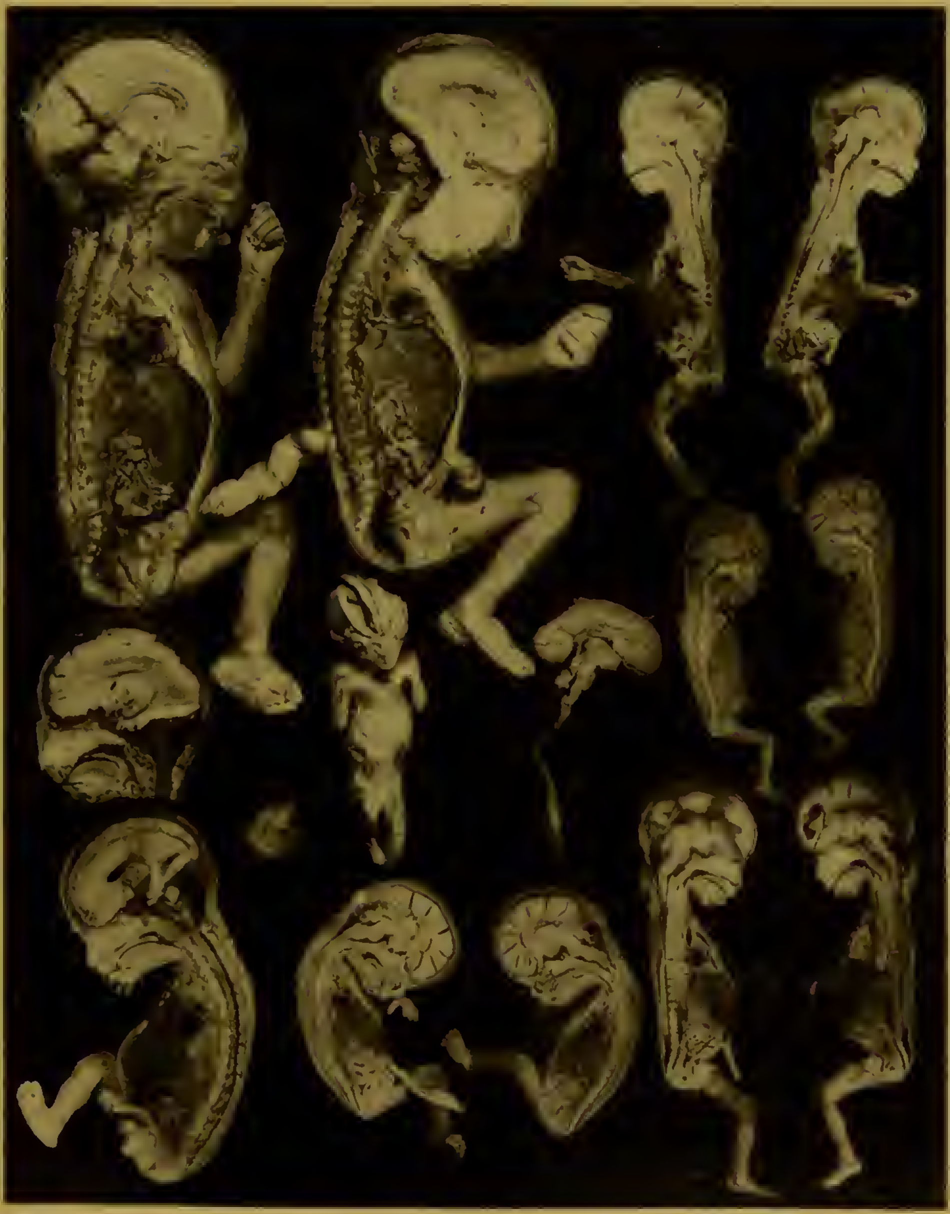

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ON THE CENTRAL NERVOUS SYSTEM.

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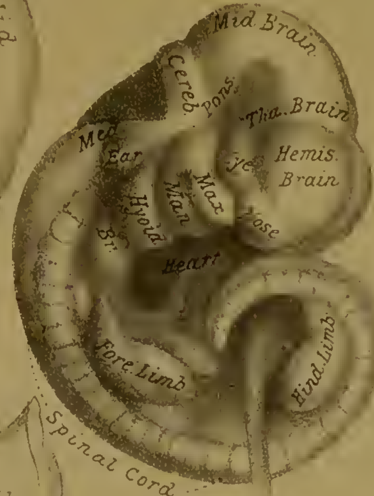
ON THE CENTRAL NERVOUS SYSTEM.

Fig. 1.
× 9

Human Embryo.

Fig. 2.
× 9



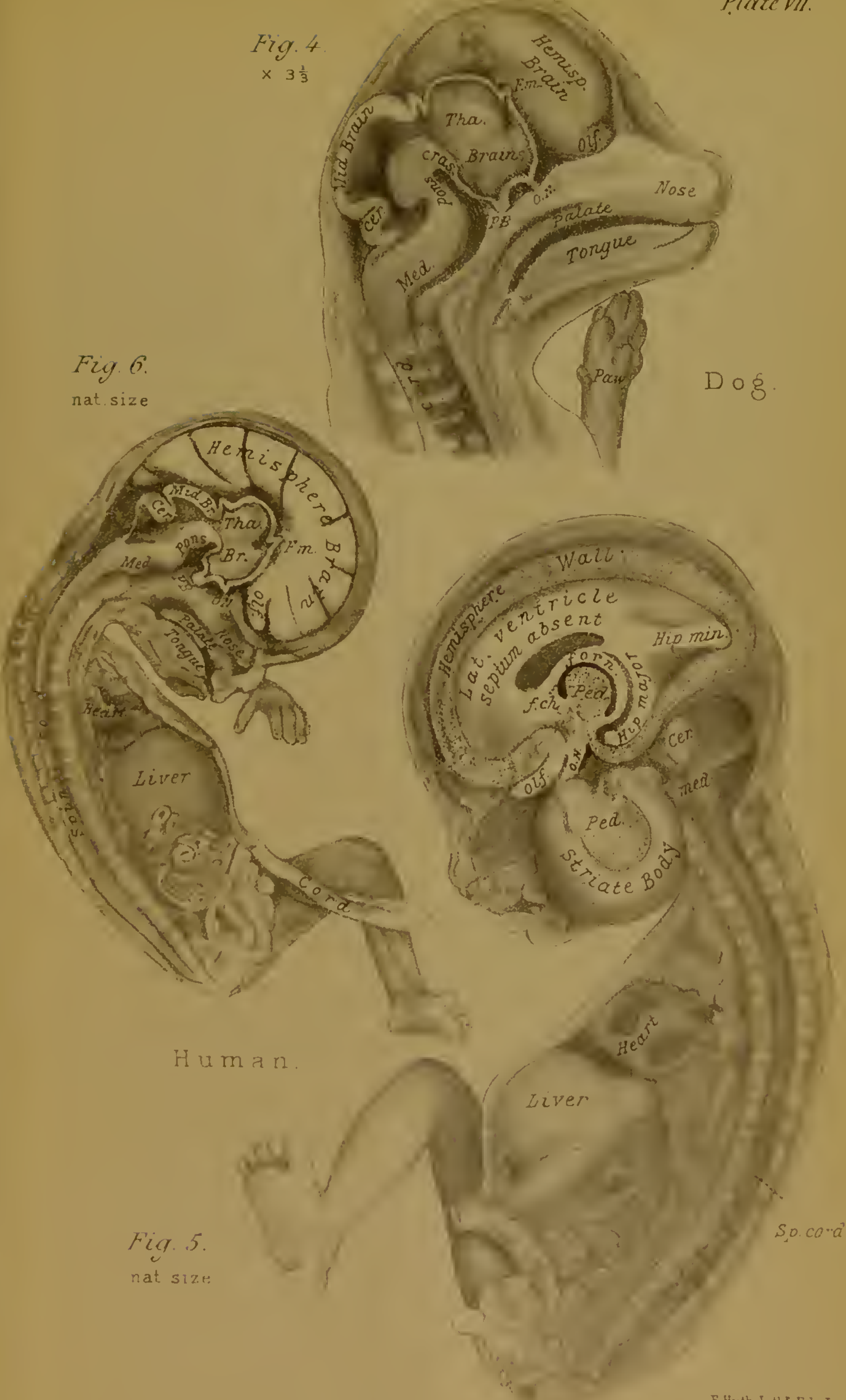
Rat Embryo
12 days 16 hours.

Fig. 3.
× 10

Sheep Embryo

DR FRASER ON THE CENTRAL NERVOUS SYSTEM.

F. Huth Lithr Edinr



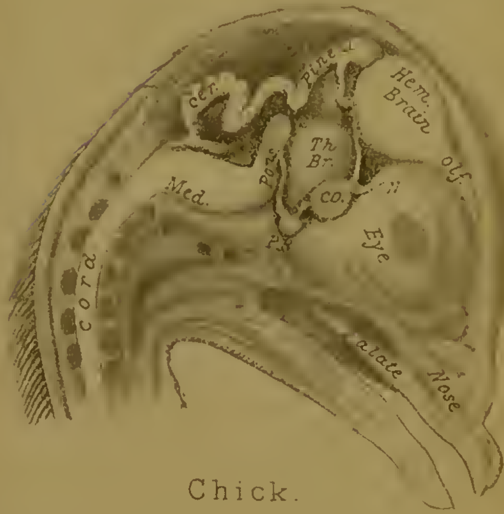
D^R FRASER ON THE CENTRAL NERVOUS SYSTEM.

Trans. Roy. Acad. Med. Ireland, Vol. XII.
Plate VIII.

Fig. 7.
× 10

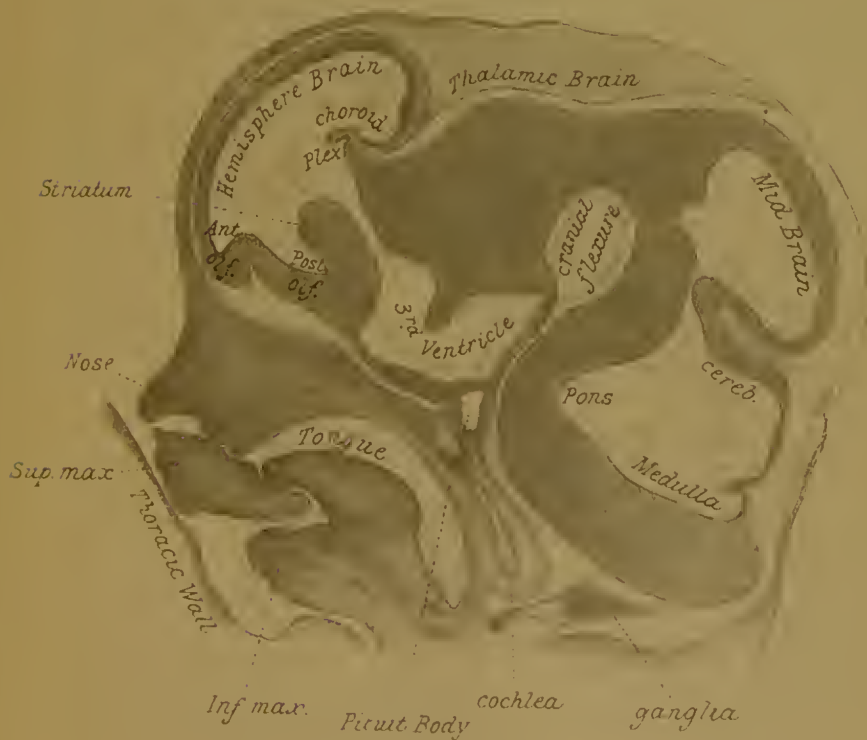
Sheep.

Fig. 9.
× $3\frac{1}{3}$



Chick.

Fig. 8.
× 10



Sheep.

F Huth, Lith^r Edin^r

(II.)

ON THE LOBUS OLFACTORIUS IMPAR.

Much interest has recently been aroused and a good deal of discussion has followed the publication of the first part of von Kupffer's (1) "Studies on the Development of the Head of the Craniota," in which he described the last connection between ectoderm and brain-tube as forming a neuropore situated at the anterior end of the dorsal wall of the tube—that after closure the evidence of the early presence of this neuropore was always to be found as a median, hollow, beak-like process of the tube. The ectoderm over it formed a thickened plate, and this plate and the beak-like process on gradual separation were connected by a cord.

The median ectodermal thickening he homologised with the olfactory pit or groove of the larval Amphioxus (named by von Kölliker), and with the single olfactory organ of the Monorhina. The median, hollow, beak-like process he named lobus olfactorius impar (a name already given by Langerhans to the similar median projection of the medullary tube in Amphioxus). The projection of the cavity of the ventricle into the lobus he named the recessus lobus olfactorius impar.

The cord mentioned as connecting the lobe with the median olfactory ectodermic plate he looked upon as a median olfactory nerve. This cord and plate rapidly disappeared during the development in embryos of the higher vertebrata, but it is otherwise with the lobus and

its recess, which can be readily recognised, even in the adult. Thus in the adult human brain the recess found dorsal to the anterior commissure between the two anterior pillars of the fornix, and in front of the ending of the median choroid plexus, and united fornix pillars, called recessus triangularis by Schwalbe, he considered to be the homologue of the recessus olfactorius impar. He also found the recess in the brains of other adult mammals.

Von Wijhe's previous observations on the embryos of birds agreed with those of von Kupffer in respect to the last point of connection between the brain-tube and ectoderm being always found between the lateral olfactory ectodermal plates, although he did not describe a median olfactory plate. This plate has, however, been noted by Miss Platt in Acanthias.

Rabl. Rückhard (2) also describes the recess and lobe in Selachians, and notes them as being present in Amphibia and Reptiles.

The views of His (3) are very different to those of von Kupffer. He recognises that von Kupffer has shown that the last part of the wall of the primitive ventricular cavity to lose its connection with the ectoderm is situated at the junction of its roof and anterior boundary, and that this has the form of a conical projection which remains for some time connected with the ectoderm by a cord. This projection is, however, considered by His as forming the dorsal sac of the lamina terminalis, and as having nothing to do with the olfactory function; he, therefore, calls it the angulus terminalis.

The olfactory lobes develop laterally from the lamina terminalis, and Kupffer founds his theory on the supposition that in the Cyclostoma, or Round-mouthed Animals, the neuropore runs to an unpaired olfactory organ. His claims to have shown that in these also the olfactory organ

is paired, and that what is called unpaired nasal cavity (from which they derive the name of Monorhina, or single-nostril animals) is not this in a morphological sense at all.

His describes the brain-tube as having not only a dorsal suture but also a frontal closing line, the latter extending from the infundibular recess to the angulus. The neuropore, in the sense of His, includes the whole of the lamina from the optic recess to the angulus, while in the sense of von Kupffer it includes only the angulus. He claims to have demonstrated this frontal closing line in selachians and in the rabbit.

Burckhardt (4) agrees with His that the conical projection has nothing to do with the olfactory function, and that it is formed by a recess of the ventricle, which he calls recessus interolfactorius, or recessus neuroporicus, and that there is a lamina supra-neuroporica between it and the paraphysis or anterior epiphysis of the roof of the thalamic brain.

As far as my own observations go I have long been familiar with the projection in the embryos of the dog-fish, bird, and mammal, but I am not as yet prepared to give a definite opinion as to whether it is a terminally situated sensory organ in the sense of von Kupffer, although this writer's opinion is a very suggestive one, or whether it has no claim to such a morphological status in the sense of His.

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(2) H. Rabl. Rückhard :—

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(III.)

ON VARIOUS SINGLE AND DOUBLE MONSTROSITIES, WITH REMARKS ON ANENCEPHALIC AND AMYELIC NERVOUS SYSTEMS.

THE impetus which led me to make the observations recorded here was obtained by the arrival of two living fowls with supernumerary legs, one kindly forwarded and presented to me by Mr. Russel, of Limerick, and the other by Dr. Friele, of Waterford.

Professor Cleland (1) has dealt with these abnormalities in so clear and masterly a manner that little remains for me to do except to corroborate. In the Limerick fowl the pelvic element of the supernumerary limbs lay to the right of the tail. The femoral element was single, and the muscles in some measure developed; between the single femoral element and the pelvic remains a slightly movable joint existed. The tibial element was single above and bifurcated below, the bifurcation ending in two well-developed feet, the one being the left foot of a right pelvis, and the other the right foot of a left pelvis.

Visceral duplicity was marked by the presence of three cæca. There was only one cloaca, with a single external aperture. My examination has not as yet extended so far as to say whether there was any evidence of spinal cord duplicity present.

In the Waterford fowl there was no pelvic or upper femoral element present; the single lower femoral element hung from the perineum. There were two tibiæ, ending

in two well-formed feet, which, as in the former, belonged to the adjacent sides of two pelves.

Visceral duplicity was again made evident by the presence of three cæca, and the single cloaca had two external apertures, which opened, one on either side of the single femoral element of the supernumerary limbs.

Through the kindness of many friends in Dublin, more especially the Master of the Coombe Hospital, I have been able to collect a considerable number of various forms of single and double human monsters at various ages, a large number of these being anencephalic; a smaller number being, in addition, amyelic.

A peripheral nervous system was found in all the specimens, with well-developed ganglia on the posterior roots. What struck me in particular was the presence of a fully-developed striated muscular system, in the absence of the ventral cell in the central nervous system, as it was a well-established fact that alteration in the ventral cells of the fully-formed cord led to atrophy of the muscles, especially in children, thus showing that the *rôle* of the ventral cell in the embryonic cord must be a very different one to that generally attributed to it in the fully-formed cord. It must not be forgotten, however, that the embryonic or fœtal muscular system has little opportunity to display its functional capacity, and that the trophic *rôle* of the cell may not be established.

I dissected carefully the reddish mass lying on the cranial base, called the substantia-medullo-vasculosa of Recklinghausen, and had found evidence therein of the early formation of the brain—in short, the central nervous system in all the specimens had been developed at an early period, until a date, at least, after the formation of the sensory ganglia from the medullary ridge and adjacent ectoderm; then development had ceased in the central

nervous tube from some pathological cause. There was clear evidence that the development of the peripheral nervous system, once started from the closing lips of the central tube, can go on quite independent of it, as was shown by its presence in a well-developed condition in all my specimens, and this in the absence of both brain and cord.

The full significance of these facts for the independence of the peripheral nervous system, after a certain stage, and for the presence of fully-developed muscular and other systems, has not as yet been fully appreciated.

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(IV.)

A CASE OF COMPLETE TRANSPOSITION OF THE THORACIC AND ABDOMINAL VISCERA.

THE specimen exhibited at the meeting and recorded here was obtained in the dissecting room during the course of the Winter Session, 1893-94. It occurred in a female subject about forty-five years, of low stature, height only 4 ft. 2 in. I could not obtain any details as to the personal history. The condition must be a very rare one, as my personal experience has now extended over at least 1,400 subjects, and this is the first example I have met with.

The transposition is complete, not only in regard to the viscera of both thorax and abdomen but also to the blood-vessels and the thoracic duct.

In regard to the cause of such transpositions the most plausible theory would be to consider the female subject as having been one of twins developed from a single egg and in one set of membranes, dichotomy being complete, to support which I exhibit a double monster in which dichotomy is complete except in the thoracic region (thoracopagus), and in which the right of the two fœtuses has transposition of the viscera—a fact already noted by Förster (Missbildungen des Menschen. Jena. 1865. P. 136). This same fact had been suggested by Mr. Morrant Baker to Mr. Bland Sutton, as stated in his work on Evolution and Disease. London. 1890. P. 132.

This is not the explanation given by the great embryologist, von Baer, who, on rare occasions finding the embryo with its right side directed towards the yolk instead of the left as was

usual, considered this to be the cause of transposition of the viscera.

The number of cases recorded of genuine congenital transposition of the organs of both cavities, thorax and abdomen, is not numerous, and this number has been vitiated by including under the heading cases of transposition of the thoracic and abdominal viscera occurring separately, but even including these wrongly so recorded, the entire number would not reach two hundred. In the references which I have appended, the 1st, 2nd, and 5th will enable any reader interested to reach the source of cases on record up to their respective dates. The 6th and 7th are cases recorded during the last year.

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(1) Wenzel Grüber—Archiv. für Anat. und Physiologie. 1865. He gives a list of 79 cases.

(2) Scheele—Berliner klin. Wochenschrift, 1875, No. 30, p. 419—added a list of fourteen cases.

(3) Burgl.—Inaug. Diss. München, 1876, zur Casuistik des Situs Viscerum Mutatus—adds four cases and deals with previous ones.

(4) Potamianos—Inaug. Diss., Berlin, 1879—adds three cases, and contains Grüber's catalogue.

(5) G. J. Fisher—Vol. VII., Buck's Ref. Handbook of the Med. Sciences, p. 241, 1889—refers to the cases in English Literature chiefly, and directs attention to the foreign ones, and to the manner in which complete and incomplete cases have been mixed.

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(7) Herrick, Henry J.—A case of Transposition of the Viscera. Med. Record, New York, V. XLVI., N. 4, p. 108.